UNITED STATES SPECIAL OPERATIONS COMMAND

Proposal Submission

The United States Operations Command's (USSOCOM) mission includes developing and acquiring unique special operations forces (SOF) equipment, material, supplies and services. Desired SOF operational characteristics for systems, equipment and supplies include: lightweight and micro-sized; reduced signature/low observable; built-in survivability; modular, rugged, reliable, maintainable and simplistic; operable in extreme temperature environments; water depth and atmosphere pressure proof; transportable by aircraft, ship and submarine, and deployable by airdrop; LLPI/LPD jam resistant C3I, electronic warfare capable of disruption and deception; near real-time surveillance, intelligence and mission planning; highly lethal and destructive; low energy/power requirements; and compatible with conventional force systems.

USSOCOM is seeking small businesses with a strong research and development capability and an understanding of the SOF operational characteristics. The topics represent a portion of the problems encountered by SOF in fulfilling its mission.

Inquires of a general nature or questions concerning the administration of the SBIR program should be addressed to:

United States Special Operations Command
Attn: SOAL-KS/Ms. Karen L. Pera
7701 Tampa Point Blvd.
MacDill Air Force Base, Florida 33621-5316
Tel: (813) 828-7549
Fax: (813) 828-5481
Email: perak@socom.mil

USSOCOM has identified 4 technical topics for the FY '00.1 solicitation. Proposals will only be accepted for these 4 topics. The USSOCOM technical offices responsible for the research and development in these specific areas initiated topics. The same office is responsible for the technical evaluation of the proposals. Proposal evaluation factors are listed below. Each proposal must address each factor in order to be considered for an award. Scientific and technical information assistance may be requested by using the DTIC SBIR Interactive Technical Information System (SITIS).

Firms may submit a proposal with an optional task, which would be performed during the period between Phase I-completion and Phase II contract award. The optional task provides the opportunity to reduce the gap between Phase I and II funding. The maximum amount of SBIR funding used for an USSOCOM Phase I award, with Option, is $100,000. Options must be submitted with the basic Phase I proposal and will be included in the basic Phase I proposal 25-page limitation. The basic Phase I proposal shall be evaluated exclusive of the option tasks and must be proposed and priced separately. The option portion of the proposal will be evaluated using the same evaluation criteria as Phase I proposals. The transition option work shall be included as an option in the Phase I contract and evaluated for USSOCOM unilateral exercise at any time after Phase I award through the conclusion of the basic Phase I contract. The maximum time frame for a Phase I with or without option is 6 months. Exercise of any option shall be at the sole discretion of USSOCOM and shall not obligate USSOCOM to make a Phase II award.

Evaluation Criteria – Phase I & II

1) The soundness, technical merit, and innovation of the proposed approach and its incremental progress toward topic or subtopic solution.

2) The qualifications of the proposed principal/key investigators supporting staff, and consultants. Qualifications include not only the ability to perform the research and development but also the ability to commercialize the results.

3) The potential for commercial (Government of private sector) application and the benefits expected to accrue from this commercialization.

Selection of proposals for funding is based upon technical merit and the evaluation criteria included in the solicitation. As funding is limited, USSOCOM will select and fund only those proposals considered to be superior in overall technical quality and most critical. USSOCOM may fund more than one proposal in a specific topic area if the technical quality of the proposals are deemed superior, or it may fund no proposals in a topic area. Fast Track Phase II proposals will be evaluated under the Fast Track standard discussed in Section 4.3 of this solicitation.

USSOCOM also encourages contractors to participate in the SBIR Fast Track program as described in the DOD 00.1 Solicitation. Proposing Options in the Initial proposal will not prevent a contractor from participating in the Fast Track Program, however, the total USSOCOM funds for a Phase I, Options, and the Fast Track funding will not exceed $140,000. It is anticipated the vast majority of Fast Track proposals will receive interim funding between Phases I and II, and that the percentage of Phase I Fast Track projects that are selected for Phase II awards should be significantly higher that the overall percentage of Phase I projects that are selected for Phase II.

The Phase II enhancement plan for the Special Operation Command is intended to encourage the acquisition programs to leverage the technology being developed under the SBIR program. The SBIR program will provide a one to four match of SBIR dollars to non-SBIR program dollars (from acquisition programs, the private sector, etc.) for Phase II work, not to exceed $100,000 in additional SBIR funding. The additional SBIR dollars will only be available for testing and/or further development that will result in a prototype as a deliverable. Offerors are strongly encouraged to develop a Phase II proposal that will include a tangible product to be used for marketing purposes.

Electronic Submission Instructions

DoD and USSOCOM have implemented an electronic proposal submission process. The Proposal Cover Sheet (formerly, "Appendix A and B") and the Company Commercialization Report Data will be submitted electronically at WWW.DODSBIR.NET/SUBMISSION. The help desk for this site is SBIRHELP@teltech.com or 1-800-382-4634. For assistance with technical proposal uploads, phone 727-549-7030 or duffj@ctc.com. The Cost Proposal is to be submitted using the format shown in Reference A of the DOD SBIR Solicitation. The Cost Proposal will be submitted as part of the technical proposal and is included in the 25 page technical proposal maximum. One paper copy of the Proposal Cover Sheet, Company Commercialization Report, cost proposal, and technical proposal is required with an original signature and will be submitted to the address shown below by 3:00PM EST on January 12, 2000:

United States Special Operations Command
Attn: SOAL-KB/SBIR Program, Topic 00-00_
7701 Tampa Point Blvd.
MacDill Air Force Base, Florida 33621-5316
(Phone number for express packages is 813-828-6512)

USSOCOM requires all Phase I monthly reports to be submitted via e-mail. Offerors must understand e-mail is the communication medium of choice for the SBIR program. Should an offeror be awarded a Phase I, the offeror will be expected to be able to communicate reports via e-mail.

Electronic Technical Proposal Submission

The term "Technical Proposal" refers to the part of the submission as described in Section 3 of the Solicitation. WordPerfect, Text, MS Word and MS Works are the preferred formats for submission of proposals for all systems. Please use standard fonts in order to prevent conversion difficulties. The offeror is encouraged, but not required, to embed graphics within the work processed document. Separate files may be submitted as Bitmap (.bmp), Graphics Interchange Format(.gif), JPEG (.jpg), PC Paintbrush (.pcx), WordPerfect Graphic (.wpg) and Tagged Image Format (.tif). The various files comprising the electronic version are required to reflect the paper version and will not exceed the page limitation. The offeror is responsible for performing a virus check on each proposal submitted via the internet address. The detection of a virus on any submitted electronic technical proposal may be cause for the rejection of the proposal. Offerors will receive an electronic confirmation receipt of the proposal. The proposal will not be opened prior to the closing date and time. Withdrawal of proposals must include the topic number and the title of the proposal and may only be made by an officer of the company and must be made electronically. We strongly suggest that the files be Zipped. Previous experience has shown some internet service providers (ISPs) are limited as to the size of the files they can transmit or they may take too long to transmit and will "time-out". Recommend you contact your ISP provider several weeks prior to submission of the proposal to determine if they will be able to transmit the expected size file. USSOCOM will not accept e-mail submissions. The web sites stated above **MUST** be used for the submittal process.

USSOCOM offers information on the Internet about its SBIR program at http://www.socom.mil and http://www.acq.osd.mil/sadbu/sbir.

USSOCOM
FY ‘00.1 SBIR TOPIC INDEX

USSOCOM
FY ‘00.1 SBIR TOPIC DESCRIPTION

SOCOM 00-001 TITLE: Extreme Environment Hand-Wear system

TECHNOLOGY AREAS: Human Systems

OBJECTIVE: Design a multi-purpose hand protection system that: protects from extreme environmental conditions, including wind, rain, temperatures down to -40F, while providing the wearer comfort and sufficient dexterity to perform mission essential tasks such as rappelling, fast-roping, operating a weapon.

DESCRIPTION: Special Operations Forces (SOF) use a variety of protective hand-wear but no single system offers the operator sufficient protection from the elements while providing for the dexterity and durability to perform all mission essential tasks. Of primary interest are novel and innovative solutions, e.g., new and novel applications of available or emerging materials in innovative designs/configurations, as there is nothing in the commercial or military market, or under development that will provide the desired capability.

PHASE I: Survey and obtain or develop candidate hand-wear materials, designs, configurations, and systems for evaluation. Determine, by calculation, sample testing or simulation, the value of conceptual system(s) in the context of SOF operating environments and mission essential tasks. Prototype most promising candidates and conduct laboratory testing to establish environmental and ergonomic performance, and conduct a qualitative assessment of compatibility with SOF mission essential tasks. This will lead to a recommendation for Phase II design(s).

PHASE II: Develop applicable and feasible prototype demonstrations and/or proof-of-concept devices for the approach described, and demonstrate the degree of commercial viability.

PHASE III DUAL USE APPLICATIONS: This system could be used in a broad range of military and civilian applications where extreme environment hand protection with maximum dexterity/durability is necessary - for example, helicopter door gunners, pipeline operators, snow mobilers and ice boaters.

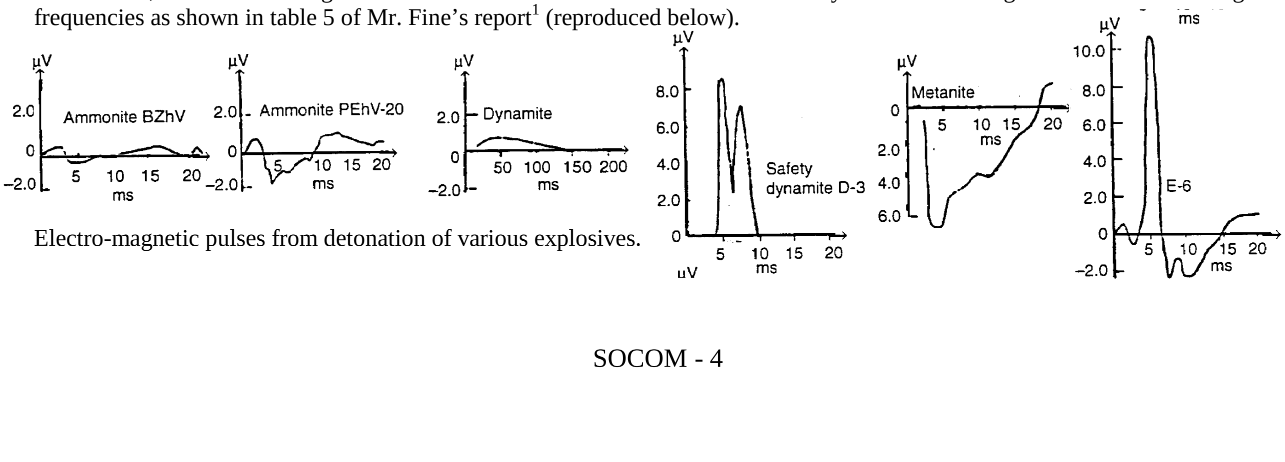
SOCOM 00-002 TITLE: RF Detector/Emitter

TECHNOLOGY AREAS:Chemical/BiologicalDefense, Sensors/Electronics/Battlespace, Weapons

OBJECTIVE**:** To investigate explosives that emit a discrete radio frequency (RF) signal when activated. Specifically, we will search for a small explosive, which can be added to blocks of C4. When the C4 is activated, the additive will ignite and a discrete RF signal will be emitted. This RF signal will then be detected by receivers in subsequent detonating charges. Once this signal is received, the charges will be detonated. These charges also contain the additive that will emit an RF signal to other follow up explosive charges. It is clear that with the use of this additive, one can activate several in-line explosive charges by sympathetic detonation (i.e. without the use of cables connecting the linear array of charges).

DESCRIPTION**:** It is a known fact that during an explosion an electrical pulse is generated. The pulse characteristics are not only dependent on the type of explosive, but also on its size, shape and containment. Much literature exists on the RF radiation from explosions. Mr. Fine and Mr. Vinci[1] conducted an extensive literature search of emitted frequencies from various explosives.

During their literature search, Mr. Fine and Mr. Vinci came across explosives that emit distinctive pulse shapes. Figure 3 on page 9 of their report[1] (reproduced below) shows six distinctively shaped pulses in the amplitude range of 0.5 to 10 microvolts from the six different explosives. These pulses were reported by Stuart[2]. Anderson and Long[3] found that the electromagnetic pulse shape and amplitude from detonation of tetryl or Composition B were affected by encasing the charges in 0.5 inch thick plaster of paris, or be seeding the uncased explosive with 15 percent by weight of sodium bicarbonate powder[4]. Takakura[5] reported E-fields on the order of 400 microvolts/meter in the frequency band from 6 to 90 MHz at distances on the order of 1m, when 0.1 to 0.4 g of lead azide were detonated[6]. The observations by different investigators cover a wide range of frequencies as shown in table 5 of Mr. Fine’s report[1] (reproduced below).



Electro-magnetic pulses from detonation of various explosives.

Table 5. Frequency bands observed by investigators reviewed.

Investigator	Type of explosive used	Amount of explosive used	Delay/ duration of observed signals	Frequency range	Possible cause suggested by authors
		Experimental values of frequency ranges			
Trinks	Tube-launched artillery projectiles	None given	—	1–100 kHz	Muzzle flash, ionization of gases near muzzle.
				2 MHz–1 GHz	Pulses upon impact at target.
				10 MHz–2 GHz	Radiation at detonation from "microsparks" caused by charge equalization at detonation.
Takakura	Lead azide	0.1–0.4 g	80–100 μs delay	6–90 MHz	Acceleration of electrons ejected by ionization and dipole formation at shock front.
Stuart	Large caliber guns		—	250 MHz–1 GHz	None given, experimental results only.
Curtis	RDX	10 g	2 s delay/19 s duration	0.5–350 Hz	None given, experimental results only.
Gorshunov et al	50/50 trinitrotolul hexogen	1000–5000 g	—	30 Hz–20 MHz	Electrical charges generated asymmetrically from scattered electrified detonation products.
Cook	Composition B	70–1100 g	—	Below 10 kHz	Gaseous detonation products form a plasma at surface of gas cloud from ionization by passing through earth's electric field. Gas cloud discharges on contact with ground.
Wouters	None given	1,300 g 500 ton (= 4.5×10^8 g)	None explicitly given 8 ms duration (1.3 kg) 32 ms duration (500 ton)	—	Blast temperature ionizes detonation products and ambient air and produces a plasma.
van Lint	Bare spheres to metal-cased bombs	10–345,000 g (bare spheres to metal-encased bombs)	100–200 μs delay	50 MHz–1 GHz	Separation of charge at interface of explosion products and air to form a vertical dipole moment, with asymmetry induced by reflection of shock wave from ground. Electric sparks from explosion products interacting with casing fragments.
Andersen and Long	Bare, plaster-encased, and seeded explosives Tetryl, Composition B	20–1,087 g	300–600 μs delay	Less than 600 kHz	Detonation ionizes detonation products, which transfer charge by friction to inert casing particles and fragments.

Investigator	Type of explosive used	Amount of explosive used	Delay/ duration of observed signals	Frequency range	Possible cause suggested by authors
		Theoretical estimations of frequency ranges			
Fine and Vinci	Theoretical calculations on model of bare generic explosive with 25-MJ yield	Approximate size of 60-mm mortar	—	0–2 THz	Electrons accelerating across shock wave.
				0–3 MHz	Electrons accelerating across plasma shell.
				3 MHz	Electrons accelerating in earth's ambient magnetic field.

Our aim is to select a seeding agent, which when enclosed and activated by the main charge, will produce a discrete RF signal that can be detected and used to activate subsequent explosive charges. Another variation is to seed a small portion of the main charge and encapsulate it. The encapsulated charge is activated first, so it emits the RF signal prior to detonation of the main charge.

The employment of this product with explosive charges will eliminate the need for connecting cables. Thus, lessening the weight the operator must carry, as well as the complexity and time expended to set up multiple charges.

PHASE I: Investigate this phenomenon and determine "coded" RF signals that can be generated. For this study, various antennas, explosive shapes and sizes, containment materials and additives will be investigated.

PHASE II: Based on the results of Phase I, pellets will be constructed, which when added to a main charge will produce the expected RF signal and sympathetic triggering of subsequent charges. Testing should show that these pellets, when added to a small portion of the main charge, are activated prior to detonating the main charge and emit the expected RF signal. Testing should also show that receivers in subsequent charges will detect the RF signal and can initiate detonation of its pellet and explosive charge.

PHASE III DUAL APPLICATIONS: The technologies developed under this program will produce additives, which when combined with a main charge are used to activate other explosives without physically connecting them. These systems will be very effective in mining operations, avalanche control and demolition operations where precise control and activation of consecutive charges is required.

REFERENCES:

[1] Jonathan E. Fine and Stephen J. Vinci , “Causes of Electromagnetic Radiation from Detonation of Conventional Explosives: A Literature Survey,” Army Research Laboratory Report No. ARL-TR-1690, DTIC Reference: ADA359740, December 1998, Adelphi, MD 20783-1197.

[2] William D. Stuart, “Data Interpretation for Hostile Weapons Location Program, Vol IV: Electromagnetic Emissions from weapons and Explosions,” Advanced Research Projects Agency (now DARPA), ESD-TR-75-221, June 1975, p.22.

[3] W.H. Andersen and C.L. Long, “Electromagnetic Radiation from Detonating Solid Explosives,” J. Appl. Phys., Vol. 36, No. 4, April 1965, pp 1494-1495.

[4] Fine and Vinci, Op. Cit. Pp 16-18.

[5] Tatuo Takakura, “Rad Noise Radiated on the Detonation of Explosive,” Publications of the Astronomical Society of Japan, Vol.7, No. 4, 1955, pp 210-220.

[6] Fine and Vinci, Op. Cit., pp 25-26.

SOCOM 00-003 TITLE: <u>High Performance Assault Zone Marking System</u>

TECHNOLOGY AREAS: Air Platform, Sensors/Electronics/Battlespace, Weapons

OBJECTIVE: Provide an assault zone marking system that can guide aircraft doing instrument approaches in adverse weather (200’ ceiling/.5 mile visibility).

DESCRIPTION: Assault zone marking systems facilitate instrument approaches of fixed and rotary wing aircraft. Special Operations Forces operating in extremely low ceiling/visibility (LC/V) conditions and with minimal administrative and logistics support. Present assault zone lighting systems do not always provide sufficient illumination for effective operations in these situations. At the same time, the solution set is somewhat limited because SOF must utilize self-contained, man-portable, and rapidly deployable systems. New technologies are available, across the electromagnetic spectrum, that can be used synergistically with existing aircraft sensors to solve this problem. For example, high intensity/efficiency lamps and lasers can greatly increase the visibility of current assault zone lighting systems without increasing operational signature or power requirements.

PHASE I: Analyze the operational deficiency and constraints, and propose alternative solutions. Demonstrate performance improvements over current assault zone lighting systems or completely new solutions to this problem, by laboratory-level demonstration, simulation, or calculation. Propose operational configuration and concept of the most promising alternatives.

PHASE II: Design, build, test, and report on the optimal design resulting from Phase I, and fabricate flying test-bed brass-board prototypes.

PHASE III DUAL USE APPLICATIONS: Boating, automotive, and aircraft industries would utilize high performance/efficiency situational awareness systems for operating in poor visibility conditions. For example, if the optimal solution was a high performance landing zone lighting system it would have applications for other government agencies (e.g. forest service to assist in marking locations during forest fire operations), and economical marking of temporary or small commercial landing strips.

SOCOM 00-004 TITLE: <u>SOF Ground Route Planner</u>

TECHNOLOGY AREAS: Information Systems, Sensors/Electronics/Battlespace, Human Systems

DOD ACQUISITION PROGRAM SUPPORTING THIS TOPIC: Mission Planning and Rehearsal (MPARE)

OBJECTIVE: Design and build an interactive software application which uses all levels of Digital Terrain Elevation Data (DTED), Digital Feature Analysis Data (DFAS), and Interim Terrain Data (ITD)/Terrain Analysis Data Base (TADB) to allow an operator to compare an estimated level of work associated with one potential route to another.

DESCRIPTION: SOF personnel routinely have to carry loads in excess of 100 pounds when they conduct cross country ground movements. Accordingly, the level of effort required to move across terrain often is a major planning factor. Currently, no known tool tailored to the needs of these individuals exists. The route they select is based on a variety of factors, ranging from a gross estimation of the difficulty of the terrain, safety, likelihood of detection from ground and air based observers, to the potential presence of hostile elements. Often the chosen route is a compromise of several mission-related factors, and is selected in a time constrained environment. The lack of planning time often results in a less than optimum selection. Providing a tool to calculate a “work factor” for each route, or one that will generate a number of optimum routes, with associated time-lines, will greatly assist planners.

Given the work required on a nominal route--a flat straight line--as a reference factor, the software should be able to use standard digital terrain information to calculate the work associated with traversing a particular route. Work calculations should be based on two primary factors: change in elevation and obstacle transit. Other factors, such as weather and urban terrain, will also apply. Changes in elevation along a route have a major impact on the effort required to use it. Climbing (positive elevation changes) requires the user to expend major energy reserves. Descending (negative elevation changes) also requires the user to expend much more energy than he would on a level route. Traditional work calculations will factor the potential energy gained in climbing as a savings for a descent. This is not true for this situation, where descending is added work, and often almost as hard as climbing. Also, transiting obstacles usually directly adds to work. Traversing a mangrove swamp, for example, is a slow and work intensive process. In the rare instances where an obstacle has negligible impact on work, time is often the most affected factor.

Both input and output formats and processes must be user friendly and intuitive. User programmable variables must make sense to an average user. Pop-up help cues should be built-in. Output should be immediately recognizable to the user. The route walk-through visualization should be as realistic as feasible—given funding constraints. Should vertical overhead imagery be available, the software should have a mechanism to import it and warp it to DTED derived contours, or at least the ability to be upgraded to perform this function with minimal effort.

Inherent in this requirement is researching “industry standard” work factors related to the task. Where needed work factors do not exist, experiments should be conducted to develop them.

The software should be compatible with a Windows NT environment on a high-end personal computer (PC). The software should be able to work in both a network environment and on a stand-alone PC.

PHASE I: Demonstrate the likelihood that a new and innovative development approach can meet the broad objectives described above, and demonstrate user interfaces.

PHASE II: Demonstrate applicable and feasible prototype demonstrators and/or proof-of-concept systems for the described requirement, and demonstrate a degree of commercial viability.

PHASE III DUAL USE APPLICATIONS: The technology developed under this SBIR has additional commercial applications. These additional applications include:

Military:

- Ground sensor emplacement planning tool.
- Determine likely enemy axis of approach.
- Convoy route planning.
- Conventional force ground tactical movement planning tool.
- Mission rehearsal support.
- Terrain following or nap of the earth low-level aviation mission preparation visualization tool.

Civilian:

- Planning tool to support recreational activities.
- Planning tool to assist in Search and Rescue planning.
- Planning tool to assist in fighting forest fires.
- Planning tool to select optimal ground routes for new roads, railway systems, pipelines, aqueducts, and recreational trails.